Integrating seasonal climate forecasts into adaptive social protection in the Sahel

Climate and Development

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tcld20

Integrating seasonal climate forecasts into adaptive social protection in the Sahel

Joseph Daron , Mary Allen , Meghan Bailey , Luisa Ciampi , Rosalind Cornforth , Cecilia Costella , Nicolas Fournier , Richard Graham , Kathrin Hall , Cheikh Kane , Issa Lele , Celia Petty , Nyree Pinder , Jennifer Pirret , Jessica Stacey & Helen Ticehurst

To cite this article: Joseph Daron , Mary Allen , Meghan Bailey , Luisa Ciampi , Rosalind Cornforth , Cecilia Costella , Nicolas Fournier , Richard Graham , Kathrin Hall , Cheikh Kane , Issa Lele , Celia Petty , Nyree Pinder , Jennifer Pirret , Jessica Stacey & Helen Ticehurst (2020): Integrating seasonal climate forecasts into adaptive social protection in the Sahel, Climate and Development, DOI: 10.1080/17565529.2020.1825920

To link to this article: https://doi.org/10.1080/17565529.2020.1825920

CLIMATE AND DEVELOPMENT
https://doi.org/10.1080/17565529.2020.1825920

VIEWPOINT

Integrating seasonal climate forecasts into adaptive social protection in the Sahel

Joseph Daron[a], Mary Allen[b], Meghan Bailey[c], Luisa Ciampi[d], Rosalind Cornforth[d], Cecilia Costella[c,e], Nicolas Fournier[a], Richard Graham[a], Kathrin Hall[a], Cheikh Kane[c,f], Issa Lele[g], Celia Petty[d,h], Nyree Pinder[a], Jennifer Pirret[a], Jessica Stacey[a] and Helen Ticehurst[a]

[a]Met Office, Exeter, UK; [b]Practical Action, Bamako, Mali; [c]Red Cross Red Crescent Climate Centre, The Hague, Netherlands; [d]Walker Institute, University of Reading, Reading, UK; [e]Faculty of Geo-Information Science and Earth Observation, University of Twente, Enschede, Netherlands; [f]Institut de Recherche pour le Développement, Marseille, France; [g]Norwegian Refugee Council, Niamey, Niger; [h]Evidence for Development, Reading, UK

ABSTRACT
Sahelian West Africa is a region of high year-to-year climate variability that can significantly impact on communities and livelihoods. Adaptive social protection (ASP) is being introduced in the region to support vulnerable people through enabling more effective responses to climate shocks, bridging social protection with disaster risk reduction and climate change adaptation. The ASPIRE (Adaptive Social Protection: Information for enhanced REsilience) project aimed to provide technical support to the World Bank's Sahel Adaptive Social Protection Programme through demonstrating the use of climate forecasts in ASP and promoting dialogue between climate and social protection stakeholders. Here we discuss lessons learned in the project, highlighting challenges and opportunities for including climate forecasts in early warning systems to inform ASP. We provide recommendations to help achieve ASP systems designed to use climate forecasts, arguing that tailored seasonal forecast products have potential in some countries to improve the lead time of interventions to address climate-induced disasters. Critical to this is continued investment in underpinning science and capacity building of climate and social protection stakeholders, as well as strengthened dialogue between actors to co-develop climate forecasts that provide actionable information.

ARTICLE HISTORY
Received 3 April 2020
Accepted 15 September 2020

KEYWORDS
Seasonal forecasts; resilience; food security; livelihoods; training

1. Introduction

Across the Sahel, communities depend on adequate seasonal rainfall to sustain livelihoods. Strategies exist to cope with climate extremes and high year-to-year variability in rainfall (Mertz et al., 2011; Tschakert, 2007). Yet water and food insecurity are acute threats in the region, and years with severe drought, excessive heat or widespread flooding can result in damage to land and property, and loss of life and livelihoods (Epule et al., 2014; Gautier et al., 2016; Tarhule, 2005). An estimated 20 million people face food insecurity every year during the lean season[1] (FAO, 2016). Addressing the root causes of vulnerability in the Sahel and building long term resilience to climate extremes, such as drought and floods, is vital to breaking the cycle of recurrent humanitarian crises in the region (Boyd et al., 2013).

To strengthen coping mechanisms to climate extremes and variability, and account for changing climate risks (Kendon et al., 2019; Mohamed, 2011; Sissoko et al., 2011), international donor agencies and national governments are working together to develop shock-responsive, adaptive social protection (ASP) systems (Davies et al., 2008; introduced further in section 2) in the Sahel. Coupling early warning systems with climate forecasts and livelihoods information has the potential to enable ASP through triggering actions ahead of a shock, reducing the time taken for needs assessments prior to delivering a response.

In this article, we present lessons learned from the Adaptive Social Protection: Information for enhanced REsilience (ASPIRE) project.[2] The three-year project, from March 2017 to March 2020, was funded by the UK Department for International Development (DFID) as part of the Weather and Climate Information Services for Africa (WISER) programme. ASPIRE aimed to provide technical support and advice to the World Bank's Sahel Adaptive Social Protection Programme (SASPP).[3] Launched in March 2014, the multi-donor SASPP trust fund provides funding and expertise to governments in six Sahelian countries (Burkina Faso, Chad, Mali, Mauritania, Niger, and Senegal), helping to design and implement ASP systems. Drawing on experiences in the ASPIRE project and building on existing knowledge of utilizing climate information in ASP, we discuss barriers and opportunities for successfully integrating seasonal climate forecasts into the SASPP.

Section 2 provides a background to ASP and insights from relevant literature exploring the role of climate information in social protection. Section 3 outlines the social protection and climate services landscape in the Sahel, including further details on the ASPIRE project. Sections 4 and 5 summarize the lessons learned and recommendations respectively for integrating climate forecasts into ASP.

CONTACT Joseph Daron joseph.daron@metoffice.gov.uk Met Office, FitzRoy Road, Exeter, UK

2. Adaptive social protection as a response to climate shocks

Social protection has been broadly defined as 'public actions taken in response to levels of vulnerability, risk and deprivation, which are deemed socially unacceptable within a given polity and society' (Conway et al., 2000), or 'the set of policies and programmes designed to reduce and prevent poverty and vulnerability throughout the life cycle' (ILO, 2017). In their 2001 strategy, the World Bank define it as public interventions (i) to assist individuals, households, and communities in better managing risk, and (ii) to provide support to the critically poor (World Bank, 2012). It is proposed that social protection has four functions: (i) Protection: providing direct relief from deprivation; (ii) Prevention: seeking to avert deprivation as a result of a shock; (iii) Promotion: enhancing income and capabilities to enhance livelihoods; and (iv) Transformation: addressing concerns of social equity and exclusion (Devereux & Sabates-Wheeler, 2004). This framework emphasizes the importance of reconnecting policy interventions aimed at poverty reduction to wider structural and socio-economic reform (Jawad, 2019). Examples of social protection include social assistance (e.g. cash transfers, school meals), insurance (e.g. unemployment and illness cover), labour market interventions (e.g. maternity and sickness benefits), and pensions. Only a subset of social protection interventions are directly climate-sensitive (e.g. weather-related insurance or assistance to alleviate food insecurity).

ASP aims to enable more effective responses to climate shocks through integrating climate change adaptation, disaster risk reduction and social protection into a coherent response to build resilience, protecting poor households from climate and other shocks before they occur (Béné et al., 2013; Davies et al., 2008). However, the implementation of ASP has often been difficult to achieve in practice and may not always reduce the vulnerability of all target beneficiaries (Béné et al., 2013).

It is argued that ASP can help build resilience to climate change through strengthening adaptive capacity and enabling transformational change (Bee et al., 2013; Tenzing, 2020). Godfrey Wood (2011) suggests that cash transfer programmes help build adaptive capacity and provide a 'no regret' policy, requiring little climate-related information. Yet the study doesn't consider climate variability and the potential role of shorter-term climate forecasts to inform the scale-up of programmes. Focusing on food and nutrition crises in the Sahel, Cherrier (2014) also discusses cash transfer programmes, highlighting the need to address seasonal vulnerability and peaks in demand (driven by climatic and non-climatic factors) by temporary expansion and contraction of programmes, implying a potential role for shorter-term climate information, such as seasonal forecasts. Such information may also help target social protection interventions; Johnson et al. (2013) states that 'targeting on the basis of projected regional patterns of climatic vulnerability requires extensive information about labour, poverty and long-range meteorology'.

A crucial component of ASP is the use of climate information to trigger a scale-up in social protection as a response to, or in anticipation of, a climate shock according to its expected severity (Kuriakose et al., 2013). In the case of drought, for example, by observational monitoring or prediction of meteorological indicators, such as seasonal rainfall and soil moisture – as used in the Africa RiskView software for the African Union's Africa Risk Capacity (ARC) initiative.[4] Two other examples of ASP come from East Africa: the Kenya Hunger Safety Net Programme (HSNP, 2015)[5] and Ethiopia's Productive Safety Net Project (PSNP, World Bank, 2013), both using climate observations to trigger scale-up of actions (Drechsler & Soer, 2016).

To increase the lead-time of actions, Costella et al. (2017) have outlined a conceptual framework for linking forecast-based action and financing with social protection. Forecast-based financing consists of three key elements that enable early action: (1) a set of pre-agreed triggers (or danger levels); (2) pre-defined actions to be taken when those triggers are met; and (3) a financing mechanism to automatically fund those actions (RCCC and GRC, 2017). Pilot initiatives have been introduced by humanitarian sector organizations in some countries, primarily using near-term weather forecasts (Wilkinson et al., 2018), but there are few examples of forecast-based action or financing in government-led social protection programmes.

One example where forecasts are being used to scale-up social protection is the UK cold weather payment scheme (Met Office, 2020), providing vulnerable individuals with cash payments during periods of cold weather. Each day between 1st November and 31st March, observed and forecast temperature data are taken from weather stations across the UK. If the average daily station temperature is observed as, or forecast to be, 0°C or below on average for seven consecutive days, eligible households (e.g. people receiving pension credit) assigned to that station receive an automatic payment from the UK's Social Fund, coordinated by the Department of Work and Pensions. Accurate forecasts are required to minimize the risk of payments made in vain.

For ASP to be effective, climate and livelihoods information needs to be integrated to determine the sensitivity to climate shocks among different communities at different times of the year. This information is critical to enable impact-based forecasting – i.e. forecasting the impact of weather or climate on people and infrastructure (WMO, 2015) – to help target ASP interventions and support post disaster response and rehabilitation.

3. Adaptive social protection and climate information landscape in the Sahel

3.1. World Bank SASPP and social protection

The World Bank's Sahel Adaptive Social Protection Programme (SASPP) is a major initiative aiming to build the resilience of people at national, community and household levels so they can better prepare for climate hazards and other shocks, protect their assets and livelihoods, and lessen humanitarian crises. The SASPP multi-donor trust fund was established in March 2014 with contributions from DFID, the Agence Française de Développement, and the German Federal Ministry for Economic Cooperation and Development. It has established a national social safety net programme in Chad and helped to strengthen existing programmes in other focal countries, covering 1.8 million people across the region (World Bank, 2019).

The SASPP only began strengthening early warning systems to trigger social protection responses towards the end of phase one of the programme (2015–2019) and, to the authors' knowledge, existing programmes are currently unable to scale-up in response to an anticipated climate shock. Béné et al. (2018) found that progress to develop SP systems had been hindered by institutional, financial and technical factors as well as significant gaps in knowledge, such as uncertainty in which types of SP interventions (e.g. empowering women at the household level or investing in community governance) best enable improved resilience and adaptive capacity.

Given the prevalence of food insecurity in the region, other regional and international organizations, including the World Food Programme[6] and the Food and Agriculture Organization,[7] are working closely with the SASPP and relevant government departments. Since 1999 the Permanent Interstate Committee for Drought Control in the Sahel (Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel) has engaged in the development and implementation of the Cadre Harmonisé[8] (Harmonised Framework), which is widely used by governments in the Sahel as a comprehensive analytical framework to understand current food security risks. It includes different indicators of food and nutrition security to provide forecasts of areas most at risk from food insecurity, but it does not presently include information from weather or climate forecasts.

3.2. Weather and climate services

Several regional organizations have a role in providing and translating weather and climate services for use in different sectors in the Sahel, each with different priorities and capabilities (Table 1). The six focal countries of the World Bank SASPP all have national meteorological and hydrological services (NMHS) organizations, mandated to provide weather and climate information and services to support government decision-making. They have similar responsibilities, including archiving and maintaining observed meteorological data, issuing daily weather forecasts, and producing weekly or 10-day agrometeorological bulletins. All NMHSs are involved in the PRESASS (Prévisions Climatiques Saisonnières en Afrique Soudano-Sahélienne) regional climate outlook forum to generate seasonal forecasts for the region, and most issue seasonal forecasts for their countries. Increasingly the NMHSs are developing tailored services for sectors and providing long-term climate projection information. Burkina Faso, Mali, Niger and Senegal are among the first countries to participate in pilot projects to implement the Global Framework for Climate Services (GFCS), with ambitions to grow their climate services capabilities. Mali and Senegal are also members of the RAINWATCH Alliance,[9] an open source platform providing observed climate data and early warnings, which supports interactions between climate information providers, national decision makers, intermediary groups, and local climate information users (Boyd et al., 2013; Tarhule et al., 2009). Many institutions and regional initiatives (e.g. ARC) are also strongly supported by international partners and climate service providers.

Table 1. Regional climate institutions and initiatives.

Organization	Activities
ACMAD: African Centre of Meteorological Applications for Development	Continental mandate to support training, tools and technology transfer to NMHSs. Located in Niger, ACMAD currently collaborates with AGRHYMET to coordinate the PRESASS Regional Climate Outlook Forum for Sudano-Sahelian West Africa
AGRHYMET: Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle – a specialized Agrometeorology and institution of CILSS (see below)	West African regional climate centre. Collects data (e.g. on food security and water), builds technical skills in core areas
ARC: Africa Risk Capacity – A specialized agency of the African Union	An insurance risk pool enabling participating African countries to access rapid and predictable financing following a disaster (e.g. drought) to protect the food security and livelihoods of their vulnerable populations
ASECNA: Agency for Aerial Navigation Safety	Provides weather services for aviation and TV forecasts used by the public (e.g. in Burkina Faso)
CILSS: Permanent Interstate Committee for Drought Control in the Sahel	Informs policy, training, research and pilot projects. Manages the Cadre Harmonisé, a tool for analysing food and nutrition security situations across the ECOWAS region
ECOWAS: Economic Community of West African States	Sub-regional economic grouping linked with ACMAD
PRESASS: Regional Climate Outlook Forum covering 17 countries in West and Central Africa	Meets annually to determine and communicate a consensus seasonal climate outlook for the region

3.3. ASPIRE

The ASPIRE project aimed to demonstrate how weather and climate information can inform ASP decisions and related resilience initiatives in the Sahel, engaging closely with DFID, the World Bank, and national social protection and climate stakeholders. A key objective of ASPIRE was to find suitable entry points for the development and use of climate forecasts in the SASSP. The focus on forecasts, particularly seasonal forecasts, was driven by the desire to increase lead times for early action, acknowledging that improved use of observational data to trigger the scale-up of social protection also has a vital role (Boyd et al., 2013).

An inception workshop in March 2017 preceded a project implementation phase from late 2017 to early 2020 (see Figure 1). During the implementation phase ASPIRE focused on:

1. Establishing dialogue between climate service providers, early warning institutions, and social protection stakeholders in government ministries (e.g. finance, agriculture, social care), led by an embedded consultant based in Niger;
2. Training of NMHSs to provide appropriate weather and climate information on time-scales relevant to ASP;
3. Training of social protection stakeholders to better understand weather and climate science, and explore opportunities for improved use of climate services to enable ASP;
4. Research to determine the reliability of seasonal forecasts in the region (Pirret et al., 2020) and assess relationships between seasonal climate and socio-economic conditions relevant to social protection (Pirret & Daron, 2019); and,

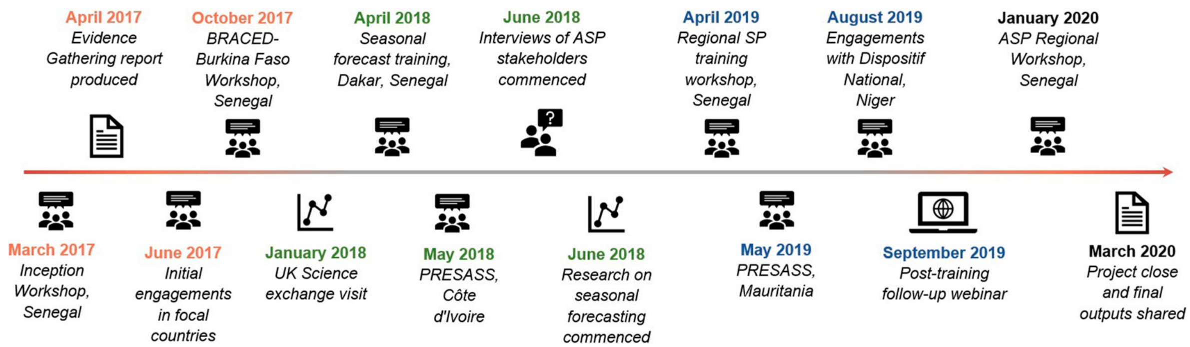

Figure 1. Timeline of key events and activities in ASPIRE.

5. Support to PRESASS to enhance seasonal forecasting approaches and raise awareness of the information needs of social protection programmes.

To help understand the potential for integrating seasonal climate forecasts into ASP, ASPIRE conducted research comparing the skill and reliability of past PRESASS seasonal precipitation forecasts to forecasts available from global dynamical models (Pirret et al., 2020). As rain-fed agro-pastoralism is a key livelihood sector, research also assessed relationships between past observed seasonal rainfall in the monsoon season (June to September) and crop production for four major crops across the Sahel (Pirret & Daron, 2019). Results show higher rainfall is associated with increased crop production at national scales, providing a basis for developing tailored seasonal forecasts, combined with knowledge of local farming practices (Akumaga et al., 2018; Boyd et al., 2013; Tarhule et al., 2009), to inform food security decisions in ASP systems.

ASPIRE also enhanced capacities of NMHSs to develop improved seasonal forecasts using dynamical models, with the aim of moving away from semi-subjective towards objective approaches. This presents an important step in using forecast data in ASP systems and aligns with wider efforts of the World Meteorological Organisation (WMO) to promote the use of objective methods in seasonal forecasting (WMO, 2020).

4. Lessons learned

In this section, we present three key lessons learned during the project on the integration of climate forecasts into ASP. In section 5 we reflect on these lessons to provide recommendations for future work to enable climate-informed ASP.

4.1. Lesson 1 – suitability of climate forecasts: there is potential to use seasonal forecasts in ASP but more work is needed to develop reliable and relevant information

Research in ASPIRE shows that seasonal climate forecasts have potential to inform ASP, but the current availability and quality of information is variable. Statistically-based subjective seasonal forecasting techniques used by NMHSs in the region (and elsewhere, e.g. Walker et al., 2019) can be prone to undesirable characteristics, such as hedging to forecasts of 'average' conditions for the season. Pirret et al. (2020) show that dynamical model forecasts issued by global producing centres generally show good skill and reliability in forecasting monsoon rainfall over the region, albeit varying geographically and with skill at relatively coarse spatial scales (e.g. the size of a country). Consistent with WMO guidance (WMO, 2020) promoting objective methods, enhanced use of dynamical models is critical to improve the objectivity of forecasts issued through the PRESASS process.

NMHSs have an important role to use local knowledge to tailor and communicate seasonal forecast information to target audiences. Yet not all NMHSs are able to utilize dynamical model output and many do not have access to relevant non-climate datasets to further understand climate impacts (e.g. agriculture or economic datasets). Moreover, there is a significant knowledge gap in understanding the impacts of seasonal climate variations on livelihoods, food security and poverty in the region. Sparse climate observation data across the region to evaluate forecasts and help understand climate impacts presents a significant barrier (Dinku, 2019).

4.2. Lesson 2 – entry points for forecast information: opportunities for integrating seasonal climate forecasts into SASPP initiatives were difficult to identify

ASPIRE originally aimed to develop a prototype climate service for the SASPP using climate forecast information. However, the nascent and fragmented nature of social protection programmes in the region, with scalable and adaptive elements only recently being incorporated into SASPP projects (World Bank, 2019), together with challenges in bridging the priorities and activities of other stakeholder organizations, meant entry points for integrating climate forecasts were difficult to identify. Rather than develop a prototype climate service, the project turned instead to focus on bringing climate and social protection stakeholders together to build and sustain dialogue. This helped generate shared understanding and articulation of systemic operational, institutional and knowledge constraints to the integration of climate and livelihoods information to promote resilience.[10]

In addition, since seasonal forecasts are probabilistic, ASP interventions would need to be informed or triggered using a probability threshold (e.g. 40% chance of very dry conditions), carrying a risk of acting in vain. For seasonal climate forecasts to inform the scale-up of ASP, systems must therefore be able to accommodate forecast uncertainty, and it's unclear if SASPP initiatives could utilize such information. Reliable and up-to-date livelihoods data is also required to understand vulnerabilities and identify appropriate thresholds amongst different communities, acknowledging livelihoods are continuously evolving and responding to other social and economic drivers. Without this context, and clear articulation and understanding of the probabilities, actions based on thresholds may not address vulnerabilities at the community scale.

To improve resilience and responses to disasters, dialogue in ASPIRE has demonstrated that climate forecasts don't have to be used directly in the SASPP to yield benefit. They may also inform broader anticipatory actions (e.g. early warnings of food insecurity), thereby reducing community and household vulnerabilities prior to a climate shock and limiting the extent of ASP scale-up. A holistic view of disaster risk reduction and the role that climate forecasts can provide, based on understanding the range and timeline of actions households can take to prepare for a shock, can complement efforts to integrate forecasts directly into ASP.

4.3. Lesson 3 – integration with early warning systems: seasonal climate forecasts cannot easily be incorporated in existing early warning systems used to inform ASP

Well established information tools and early warning systems for food security and nutrition are available in the region, which can inform ASP. The Cadre Harmonisé provides early warning using satellite-based climate monitoring information with other food security indicators. Climate forecasts are currently not included due to a mismatch between the scale, reliability and timeliness of monthly and seasonal forecasts, and the information needed as an input to the Cadre Harmonisé.

ASPIRE has helped begin the process of linking early warning systems with the regional PRESASS forum and information from NMHSs. However, PRESASS relies on ad-hoc funding and there are challenges to coordinating forum events. As a result, it continues to be held close to the monsoon onset (in late May or early June) leaving little time for intervention planning by government, disaster risk reduction and humanitarian organizations.

5. Recommendations

Reflecting on the lessons learned in ASPIRE, we provide recommendations to promote integration of seasonal climate forecasts into ASP in the Sahel or other regions. The recommendations (Figure 2) are aimed at different actors across the community working to implement ASP. For each recommendation we provide further explanation and context.

5.1. Recommendation 1: promote sustained dialogue between social protection and climate stakeholders

ASPIRE has helped initiate a dialogue between social protection and climate stakeholders in the region, building on and aligning with efforts of the SASPP and other actors (e.g. European Commission – ECHO[11]). Yet a deeper and sustained dialogue is required to bridge disciplines, priorities and agendas to enable ASP systems to integrate climate forecasts. The regional climate centres, ACMAD and AGRHYMET, have key roles in helping to strengthen inter-agency dialogue and collaboration with social protection stakeholders. Regional and national social protection forums should also reach out to NMHSs and climate experts, and new mechanisms (e.g. national dialogues for disaster risk financing) could be created to link the wider community working to reduce risks and improve climate resilience. To help bridge the gap and align priorities between social protection and climate stakeholders, the WMO should formally recognize the humanitarian sector, including social protection, as a key focus area for the implementation of the GFCS in the Sahel. This would encourage regional climate centres and NMHSs to engage in an ongoing dialogue and development of services, and raise awareness of social protection stakeholder needs for application in other regions.

5.2. Recommendation 2: improve understanding of climate impacts on livelihoods and response options to help tailor seasonal forecasts for ASP

Training activities conducted in ASPIRE highlight the need to improve livelihoods data collection, integration and analysis to enhance understanding of how seasonal climate variations impact on livelihoods. A range of tools and approaches are

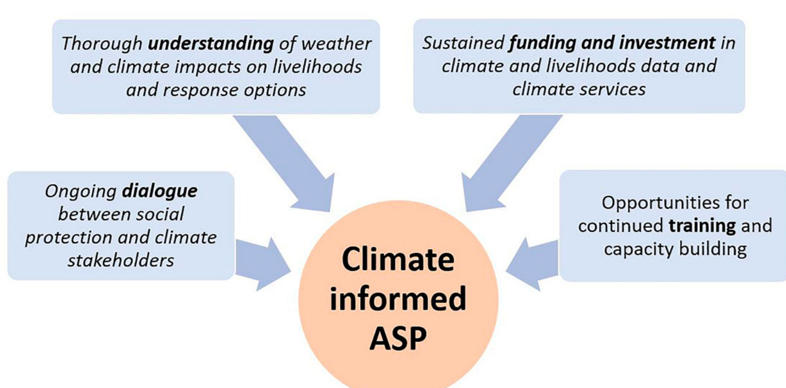

Figure 2. Key elements to promoting climate informed adaptive social protection.

available to explore these relationships (e.g. Ziervogel & Calder, 2003; Reed et al., 2013; Integrated Database for Africa Policymakers (IDAPS) initiative[12]). Cross-disciplinary collaboration is key to a richer and more robust understanding of impacts to support impact-based forecasting and better integrate seasonal climate forecasts into ASP programmes.

Further targeted research is also needed to build on assessments of past seasonal climate and impacts on livelihood and economic indicators in the Sahel (e.g. Pirret & Daron, 2019). Research should be a mixture of analytical work, engagement at the community level, and national policy and programme level engagement to further understand how vulnerable communities are impacted by and respond to climate variations, and how ASP can reduce these impacts. Furthermore, those working to implement ASP projects must better articulate and document actions that can be taken several weeks or months in advance of an anticipated climate shock. This information is needed to underpin the development of more targeted and timely forecast-based climate services to trigger an ASP action plan, or to include in early warning systems (e.g. Cadre Harmonisé).

5.3. Recommendation 3: sustain funding and investment in climate and livelihoods research, data and services

Investment in climate and livelihoods research, data and services in the region (e.g. Africa Hydromet Program[13]) is crucial to the successful integration of climate forecasts in ASP. NMHSs need sustained funding to maintain and improve observational data collection, archiving and analysis, as well as capabilities to generate and evaluate monthly and seasonal forecasts from dynamical models. In parallel, well-maintained and up-to-date livelihoods data and knowledge is essential to understand the impacts of seasonal climate variations on different livelihoods in the region, to help target ASP interventions using seasonal forecasts. There is also a need for increased and sustained funding in underpinning research (e.g. how best to combine probabilistic forecast information with skill assessments), informed by ongoing stakeholder engagement, to ensure that climate forecasts used in ASP programmes are fit-for-purpose. Finally, PRESASS plays a significant role in providing seasonal forecasts for the region, as well as an opportunity to learn from user communities and convene training. It is imperative that PRESASS secures long-term funding and support from partners to ensure its sustainability.

5.4. Recommendation 4: provide opportunities for continued training and capacity building within the climate service provider community and social protection stakeholders

ASPIRE has developed and delivered training on seasonal forecasting and impact-based forecasting to NMHSs, and developed a series of training videos covering the science and application of seasonal forecasts.[14] However, the project was unable to meet all training needs of climate service providers and ongoing support is critical. Regional climate centres, international climate service organizations and academic institutions have an important role and responsibility to help continually develop the skills of climate scientists and forecasters in the region.

Another major barrier is the limited understanding of social protection stakeholders on climate science and forecast information. The project provided some training and knowledge tools for social protection stakeholders in the region but in order to successfully implement climate-informed ASP, more opportunities for training and institutional capacity building are essential.

Notes

1. The period between harvests, from June to August.
2. https://www.metoffice.gov.uk/about-us/what/working-with-other-organisations/international/projects/wiser/aspire.
3. http://www.worldbank.org/en/programs/sahel-adaptive-social-protection-program-trust-fund.
4. https://www.africanriskcapacity.org/.
5. http://www.hsnp.or.ke/.
6. https://www.wfp.org/publications/integrated-resilience-sahel.
7. http://www.fao.org/3/a-i6226e.pdf.
8. http://www.ipcinfo.org/ipcinfo-website/where-what/cadre-harmonise-in-west-africa-and-the-sahel/en/.
9. www.rainwatch-africa.org.
10. http://www.walker.ac.uk/about-walker/news-events/connecting-climate-scientists-and-social-protection-professionals-aspire-training-in-senegal/.
11. https://ec.europa.eu/echo/files/aid/countries/factsheets/sahel_agir_en.pdf.
12. http://www.walker.ac.uk/research/projects/idaps-integrated-database-for-african-policy-makers/.
13. https://www.worldbank.org/en/results/2017/12/01/hydromet.
14. Available on the Met Office YouTube Channel: https://www.youtube.com/watch?v=CucEP23gWfU&t=92s.

Acknowledgements

The ASPIRE team is grateful for project funding from DFID through the WISER programme. We are grateful to the editor and anonymous reviewers for their helpful suggestions to improve the quality of the paper. Thanks also to Hannah Griffith for input to Figure 1 and Chris Hewitt for useful comments on the draft manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported through the WISER programme, funded by the UK Department for International Development.

Notes on contributors

Dr Joseph Daron is a Science Manager in the International Climate Services team at the Met Office. His work involves developing partnerships and collaborating with organisations across the world to co-develop and deliver climate services, helping to address the risks associated with climate variability and change.

Mary Allen is a senior expert in resilience and livelihoods at Practical Action, with a focus on West Africa.

Dr Meghan Bailey is a senior technical advisor at the Red Cross Red Crescent Climate Centre.

Luisa Ciampi is an impact officer at the Walker Institute and a PhD candidate in gender and communication in Zimbabwe.

Prof Rosalind Cornforth is the director of the Walker Institute at the University of Reading and an expert in climate resilience and development.

Cecilia Costella is a social protection and climate advisor at the Red Cross Red Crescent Climate Centre and a PhD candidate at the University of Twente.

Dr Nicolas Fournier is a science manager (energy sector) and climate change adaptation expert at the Met Office.

Dr Richard Graham OBE is an expert in seasonal forecasting and science manager in the seasonal forecast outreach team at the Met Office.

Kathrin Hall is capacity development programme lead for the Met Office, focusing on capacity development across Africa and Asia for international development.

Cheikh Kane is the West Africa focal point at the Red Cross Red Crescent Climate Centre and researcher at the Institut de Recherche pour le Développement.

Issa Lele is a climate and resilience assessment expert for the Sahel at NORCAP - Norwegian Refugee Council.

Dr Celia Petty is a co-founder of Evidence for Development and strategic lead (livelihoods) at the Walker Institute at the University of Reading.

Nyree Pinder is a global partnerships manager at the Met Office, managing partnerships with the World Bank, IFRC and United Nations agencies including the WFP and FAO.

Dr Jenny Pirret is an applied climate scientist at the Met Office, developing tailored information for applications in the UK and internationally.

Jessica Stacey is an international climate services scientist at the Met Office, working with partners to co-develop climate services in Africa and Asia.

Helen Ticehurst is a senior international development manager at the Met Office, designing and delivering international development projects across Africa.

ORCID

Joseph Daron http://orcid.org/0000-0003-1917-0264
Rosalind Cornforth http://orcid.org/0000-0003-4379-9556

References

Akumaga, U., Tarhule, A., Piani, C., Traore, B., & Yusuf, A. (2018). Utilizing process-based modeling to assess the impact of climate change on crop yields and adaptation options in the Niger River Basin, West Africa. *Journal of Agronomy*, *8*(2), 1–11. https://doi.org/10.3390/agronomy8020011

Bee, B., Biermann, M., & Tschakert, P. (2013). Gender, development, and rights-based approaches: Lessons for climate change adaptation and adaptive social protection. In M. Alston & K. Whittenbury (Eds.), *Research, action and policy: Addressing the gendered impacts of climate change* (pp. 95–108). Springer.

Béné, C., Cannon, T., Davies, M., Newsham, A., & Tanner, T. (2013). *Social protection and climate change – A paper prepared for the OECD-DAC Task team on social protection*. OECD. 27 p.

Béné, C., Cornelius, A., & Howland, F. C. (2018). Bridging humanitarian responses and long-term development through transformative changes—some initial reflections from the World Bank's adaptive social protection program in the Sahel. *Sustainability*, *10*(6), 1697. https://doi.org/10.3390/su10061697

Boyd, E., Cornforth, R. J., Lamb, P. J., Tarhule, A., Lélé, M. I., & Brouder, A. (2013). Building resilience to face recurring environmental crisis in African Sahel. *Nature Climate Change*, *3*(7), 631–637. https://doi.org/10.1038/nclimate1856

Cherrier, C. (2014, July). *Cash transfers and resilience: Strengthening linkages between emergency cash transfers and national social transfer programmes in the Sahel*. Discussion paper prepared for the cash learning partnership.

Conway, T., De Haan, A., & Norton, A. (2000, March). *Social protection: New directions of donor agencies*. Paper for the DFID-ODI inter-agency seminar on social protection, Easthamstead Park.

Costella, C., Jaime, C., Arrighi, J., de Perez, E. C., Suarez, P., & Van Aalst, M. (2017). Scalable and sustainable: How to build anticipatory capacity into social protection systems. *IDS Bulletin*, *48*(4), https://doi.org/10.19088/1968-2017.158

Davies, M., Guenther, B., Leavy, J., Mitchell, T., & Tanner, T. (2008). 'Adaptive social protection': Synergies for poverty reduction. *IDS Bulletin*, *39*(4), 105–112. https://doi.org/10.1111/j.1759-5436.2008.tb00483.x

Devereux, S., & Sabates-Wheeler, R. (2004). Transformative social protection (No. 232; IDS Working Paper, Issue October).

Dinku, T. (2019). Challenges with availability and quality of climate data in Africa. In M. M. Assefa, A. Wossenu, & G. Senay (Eds.), *Extreme hydrology and climate variability* (pp. 71–80). Elsevier.

Drechsler, M., & Soer, W. (2016). *Early warning, early action: The use of predictive tools in drought response through Ethiopia's productive safety net programme*. The World Bank.

Epule, E. T., Peng, C., Lepage, L., & Chen, Z. (2014). The causes, effects and challenges of Sahelian droughts: A critical review. 0*Regional Environmental Change*, *14*(1), 145–156. https://doi.org/10.1007/s10113-013-0473-z

FAO. (2016). *Social protection in the Sahel and West Africa: Strengthening resilience for food security and nutrition*. Retrieved January 3, 2020, from http://www.fao.org/3/a-i6226e.pdf

Gautier, D., Denis, D., & Locatelli, B. (2016). Impacts of drought and responses of rural populations in West Africa: A systematic review. *Wiley Interdisciplinary Reviews: Climate Change*, *7*(5), 666–681. https://doi.org/10.1002/wcc.411

Godfrey Wood, R. (2011). Is there a role for cash transfers in climate change adaptation?. *IDS Bulletin*, *42*(6), 79–85.

HSNP. (2015, February). *Hunger safety net programme options paper for scaling up HSNP payments*. Retrieved January 3, 2020, http://www.hsnp.or.ke/images/phocadownload/HSNP-Scalability%20Options%20Paper%20for%20financing%20February%202015.pdf

ILO. (2017). World Social Protection Report 2017–19: Universal social protection to achieve the Sustainable Development Goals International Labour Office – Geneva. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_604882.pdf

Jawad, R. (2019). A new era for social protection analysis in LMICs? A critical social policy perspective from the Middle East and North Africa region (MENA). *World Development*, *123*, 104606. https://doi.org/10.1016/j.worlddev.2019.06.029

Johnson, C., Dulal, H. B., Prowse, M., Krishnamurthy, K., & Mitchell, T. (2013). Social protection and climate change: Emerging issues for research, policy and practice. *Development Policy Review*, *31*(S2), o2–o18. https://doi.org/10.1111/dpr.12036

Kendon, E. J., Stratton, R. A., Tucker, S., Marsham, J. H., Berthou, S., Rowell, D. P., & Senior, C. A. (2019). Enhanced future changes in wet and dry extremes over Africa at convection-permitting scale. *Nature Communications*, *10*(1), 1794. https://doi.org/10.1038/s41467-019-09776-9

Kuriakose, A. T., Heltberg, R., Wiseman, W., Costella, C., Cipryk, R., & Cornelius, S. (2013). Climate-responsive social protection. *Development Policy Review*, *31*, o19–o34. https://doi.org/10.1111/dpr.12037

Mertz, O., Mbow, C., Reenberg, A., Genesio, L., Lambin, E. F., D'haen, S., Zorom, M., Rasmussen, K., Diallo, D., Barbier, B., Moussa, I. B., Diouf, A., Nielsen, J. Ø., & Sandholt, I. (2011). Adaptation strategies and climate vulnerability in the Sudano-Sahelian region of West Africa. *Atmospheric Science Letters*, *12*(1), 104–108. https://doi.org/10.1002/asl.314

Met Office. (2020). *Social protection in the UK: Cold weather payments scheme*. https://www.metoffice.gov.uk/about-us/what/working-with-other-organisations/international/projects/wiser/aspire

Mohamed, A. B. (2011). Climate change risks in Sahelian Africa. *Regional Environmental Change*, *11*(1), 109–117. https://doi.org/10.1007/s10113-010-0172-y

Pirret, J., & Daron, J. (2019). *Assessment of the relationship between seasonal meteorological variables and crop parameters in Senegal* (ASPIRE working paper). Retrieved January 3, 2020, https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/business/international/wiser/wiser0114_aspire_crops_report_0719.pdf

Pirret, J., Daron, J., Bett, P., Fournier, N., & Kamga Foamouhoue, A. (2020). Assessing the skill and reliability of seasonal climate forecasts in Sahelian West Africa. *Weather and Forecasting*, *35*(3), 1035–1050. https://doi.org/10.1175/WAF-D-19-0168.1

RCCC and GRC. (2017). *Manual for forecast based financing, red cross red crescent climate centre and German red cross*. Retrieved January 3, 2020, http://fbf.drk.de/manual.html

Reed, M. S., Podesta, G., Fazey, I., Geeson, N., Hessel, R., Hubacek, K., Letson, D., Nainggolan, D., Prell, C., Rickenbach, M. G., Ritsema, C., Schwilch, G., Stringer, L. C., & Thomas A. D. (2013). Combining analytical frameworks to assess livelihood vulnerability to climate change and analyse adaptation options. *Ecological Economics*, *94*, 66–77. https://doi.org/10.1016/j.ecolecon.2013.07.007

Sissoko, K., van Keulen, H., Verhagen, J., Tekken, V., & Battaglini, A. (2011). Agriculture, livelihoods and climate change in the West African Sahel. *Regional Environmental Change*, *11*(1), 119–125. https://doi.org/10.1007/s10113-010-0164-y

Tarhule, A. (2005). Damaging rainfall and flooding: The other Sahel hazards. *Climatic Change*, *72*(3), 355–377. https://doi.org/10.1007/s10584-005-6792-4

Tarhule, A., Saley-Bana, Z., & Lamb, P. J. (2009). Rainwatch: A prototype GIS for rainfall monitoring in West Africa. *Bulletin of the American Meteorological Society*, *90*(11), 1607–1614. https://doi.org/10.1175/2009BAMS2697.1

Tenzing, J. D. (2020). Integrating social protection and climate change adaptation: A review. *Wiley Interdisciplinary Reviews: Climate Change*, *11*(2), Article 626. https://doi.org/10.1002/wcc.626

Tschakert, P. (2007). Views from the vulnerable: Understanding climatic and other stressors in the Sahel. *Global Environmental Change*, *17*(3-4), 381–396. https://doi.org/10.1016/j.gloenvcha.2006.11.008

Walker, D. P., Birch, C. E., Marsham, J. H., Scaife, A. A., & Graham, R. J. (2019). Skill of dynamical and GHACOF consensus seasonal forecasts of East African rainfall. *Climate Dynamics*, *53*(7-8), 4911–4935. https://doi.org/10.1007/s00382-019-04835-9

Wilkinson, E., Weingärtner, L., Choularton, R., Bailey, M., Todd, M., Kniveton, D., & Cabot Venton, C. (2018). *Forecasting hazards, averting disasters: Implementing forecast-based early action at scale*. Overseas Development Institute (ODI).

WMO. (2015). *World Meteorological Organisation guidelines on multi-hazard impact-based forecast and warning services*. WMO-No. 1150. Retrieved March 25, 2020, from https://www.wmo.int/pages/prog/www/DPFS/Meetings/ET-OWFPS_Montreal2016/documents/WMOGuidelinesonMulti-hazardImpact-basedForecastandWarningServices.pdf

WMO. (2020). *Guidance on operational practices for objective seasonal forecasting*. WMO-No. 1246. https://library.wmo.int/doc_num.php?explnum_id=10314

World Bank. (2012). *Resilience, equity, and opportunity: The World Bank's social protection and labor strategy*.

World Bank. (2013). *Coping with change: How Ethiopia's PSNP & HABP are building resilience to climate change*. World Bank Group.

World Bank. (2019). *Sahel adaptive social protection program* (Annual report 2018). World Bank Group.

Ziervogel, G., & Calder, R. (2003). Climate variability and rural livelihoods: Assessing the impact of seasonal climate forecasts in Lesotho. *Area*, *35*(4), 403–417. https://doi.org/10.1111/j.0004-0894.2003.00190.x